

# Curriculum Realignment

# Curriculum Realignment Session Overview

## 1. Feelings about Grade 9 Applied Mathematics

- a. Teacher voice
- b. Student voice

## 2. Rationale for realignment

- a. The Ontario Curriculum
- b. Setting up for early success

## 3. Learning Stories

- a. 3 learning journeys from the research project
- b. Open forum



How do you feel about  
teaching grade 9 applied math?



Students respond to; How do you feel about math?

Well I never really liked math. I don't like math because it's hard and it's not just that I'm too lazy to try. I always try and do what I can. I just seem never to get it.

Students respond to; How do you feel about math?

*I hate math strongly with a passion. Every time I hear or see math I get a headache and my stomach starts to hurt.*

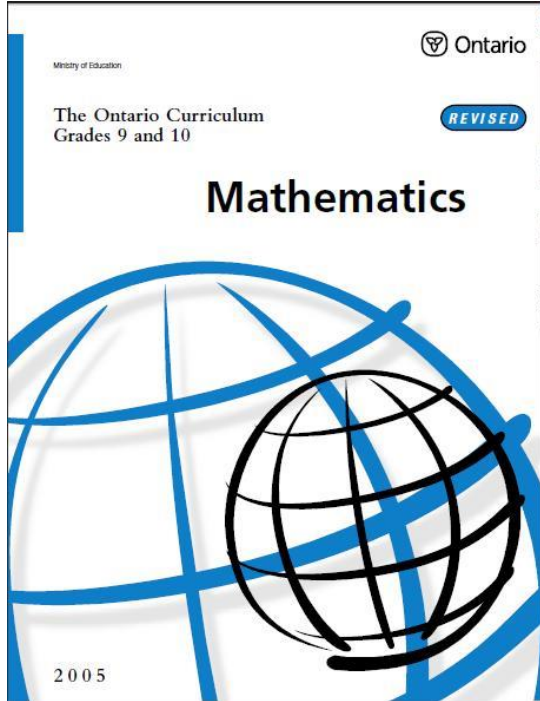
Students respond to; How do you feel about math?

**Math is the work of the devil  
and frankly I despise it.**

Students respond to; How do you feel about math?

If I was in a relationship with math  
I would beat it everyday.

# Rationale for Curriculum Realignment



Teachers are expected to weave together related expectations from different strands, as well as the relevant process expectations, in order to create an overall program that integrates and balances concept development, skill acquisition, the use of processes, and applications.

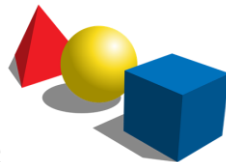
- *The Ontario Curriculum Grades 9 and 10 Mathematics 2005, page 8*



# 3 Learning Stories

**Revisioning the Scope and Sequence,**

Eastview Secondary School, Simcoe County DSB



**A Spiral Approach,** Glebe Collegiate Institute, Ottawa Carleton DSB



**Jumping Into Spiraling,** Castlebrooke, Peel DSB



# Grade 9 OAME Project Focus

## Apathy & Perseverance

Teamwork

Mindsets

White Boards

GAP Days

Re-ordering the Course

# Re-ordering the Course

## Before

Algebra

Rate, Ratio and Proportion

Relationships

Linear Relations and Rate of Change

Linear Applications

Plane Geometry

Measurement and 2D Geometry

3D Geometry

## After

Measurement and 2D Geometry

3D Geometry

Plane Geometry

Algebra

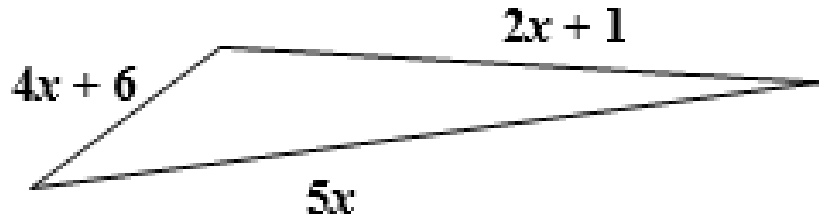
Linear Relations and Rate of Change

Relationships

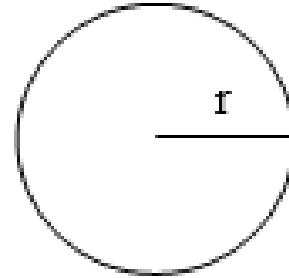
Rate, Ratio and Proportion

# Algebra Assignment

If the perimeter is 29 cm, determine the length of each side.

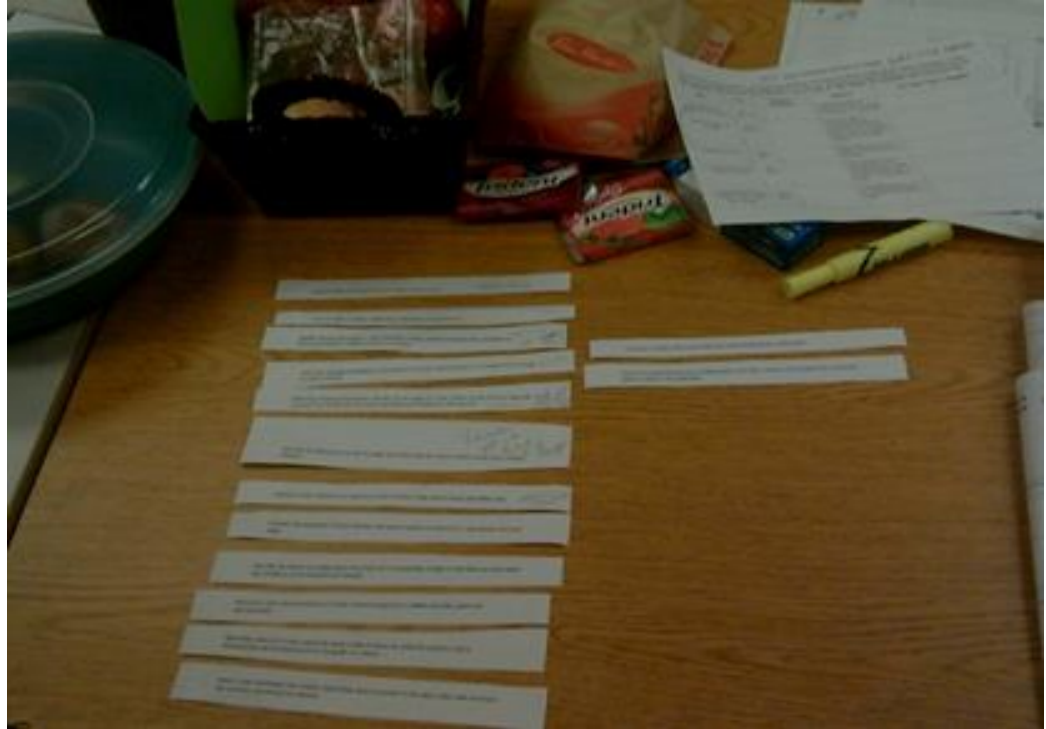


If the area of a circle is  $38.5 \text{ cm}^2$ , determine the radius.



# Scope and Sequence

Expectations were weaved  
together to create each unit.



# Unit Plan

## Unit 1 - 2D Measurement and Optimization

Unit Goal:

Topic	Date	Learning Goals	Question	I get it
Welcome to the Course Mindsets	Mon. Feb. 8	I understand the expectations for this course and will bring a calculator every day.		
Measuring Perimeter and Area	Tues. Feb. 9	I can calculate the perimeter and area of rectangles, parallelograms, circles and triangles.		
Measuring Right Triangles	Wed. Feb. 10	I can use the Pythagorean Theorem to calculate the perimeter and area of right triangles.		
Area of Composite Figures	Thurs. Feb. 11	I can calculate the area of figures that are a combination of basic shapes.		
Perimeters of Composite Figures	Fri. Feb. 12	I can calculate the perimeter of figures that are a combination of basic shapes.		

Investigating Perimeter and Area of Rectangles	Tues. Feb. 16 & Wed. Feb. 17	I can determine the maximum area or the minimum perimeter of a rectangle.		
Composite Shapes in the Real World	Thurs. Feb. 18	I can solve problems that involve composite shapes as they appear in the real world.		
Review and Diagnostic	Fri. Feb. 19	I have completed my diagnostic and have started reviewing for my test.		
Gap Day	Mon. Feb. 22	I have strengthened my skills.		
Test	Tues. Feb. 23	I have demonstrated my skills on the test.		

# Early success?

Category	Algebra		2D	
	(before)	(after)	(before)	(after)
Knowledge	87%	73%	71%	62%
Application	71%	77%	51%	68%
Thinking	62%	51%	68%	78%
Communication	68%	78%	78%	78%

# Four Block Thinking Template

making students' thinking more visible

## Thinking

A candy company makes solid chocolate oranges. The oranges are packed in cube-shaped boxes, with all sides 7.5 cm. Each chocolate orange touches each face of the box. What is the amount of empty space in the box?



### Understanding the Problem

I know...

I need to find out...

What do I predict and why?

### Make a Plan: Circle one



### Carry Out the Plan

(Show ALL your work: Pictures/Models, Numbers and Math Words)

Explain why? (Does your answer seem reasonable?)

### Answer Statement

(Use the question in your answer)

	Level 4	Level 3	Level 2	Not yet become...
Thinking Question	Student has reflected on their answer.	Student's plan has provided the correct (or very close) solution.	Student understands the problem and has completed a plan.	



# Final Exam Samples

10. You are given the question:  $3x + 2y^2 - 2x + 5y^2$ . Fred says the answer is  $1x + 7y^2$  while Susan says the answer is  $1x^2 + 7y^2$ . Explain to Susan why she is incorrect.

$3x - 2x + 2y^2 + 5y^2$   
 $= 1x + 7y^2$

Susan is wrong because she added the exponents even though they are supposed to stay the same.

11. Solve the following equations.

a)  $3x + 3 = -4$   
 $\frac{3x}{3} = \frac{-4-3}{3}$   
 $x = -3$

b)  $4x - 8 = 6x - 4$   
 $-4x = 6x - 4$   
 $-4x - 6x = -4$   
 $-10x = -4$   
 $x = 0.4$

12. The cost,  $C$  dollars, to enter a party is given by the equation:  $C = 22p + 800$ , where  $p$  is the number of people at the party.

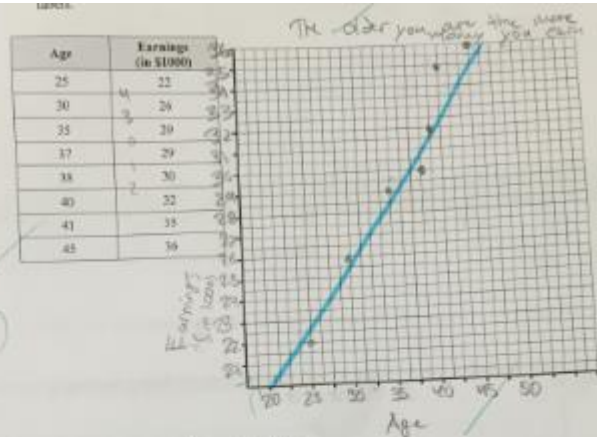
- a) What does the 22 represent in terms of this situation?  
 Cost per person
- b) What does the 800 represent in terms of this situation?  
 the initial cost of the party
- c) If the party costs \$2010, how many people are attending?
- $22(55) + 800 = 2010$   
 $1210 + 800 = 2010$   
 $2010$   
 55 people will attend.

13. At "Rent-A-Ride", it costs \$55 to rent a car plus 10 cents per kilometer driven. Circle the equation that represents this situation and explain what is wrong with the other two equations.

$C = 55d + 10$   
 this one is wrong because she 2 numbers need to be flipped around, & it is written on how 10 when it should be

$C = 10d + 55$   
 this one is right, but the 10 has to be written as 0.10 for cents.

$C = 0.10d + 55$



- b) How much money would a person age 50 earn?  
 A person is 50 would earn around 40,000 dollars but it hard to tell since it is no longer there.
- c) Refer to the hypothesis above, does the data support the hypothesis? Give reasons to support your answer. (Refer to the scatter plot.)  
 I believe the older you get the more money you make. Since the oldest person on the graph has the most amount of money.
- d) Explain what the point (41, 35) represents.  
 This point represents the amount of money a 41 year old would get.

16. The ratio of teachers to students at Eastview is 2:25. If there are 110 teachers, how many students are there?

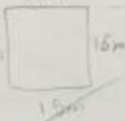
	P	A
S	25	2
T	2	110

$$\frac{25}{2} = \frac{?}{110}$$

$$110 \times 25 \div 2 = 1375$$

Therefore there are 1375 students at Eastview.

# Final Exam Samples (cont'd)

$P = 60m$   
 $A = 215m^2$   
 $4 = 15$  The dimensions 15m would be 15m  


Other options:  $15 \times 15$  to get the maximum area.  
 $16 \times 14 = 224m^2$   
 $17 \times 13 = 221m^2$   
 $18 \times 12 = 216m^2$   
 $19 \times 11 = 209m^2$

4. Find the height of the following prism if the volume is  $896 \text{ cm}^3$ .

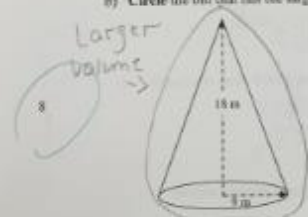
$V = lwh$   
 $V = 8 \times 8 \times h$   
 $V = 8 \times 8 \times 14$   
 $V = 896 \text{ cm}^3$   
 $h = 14 \text{ cm}$



The height is 14 cm

5. A farmer is trying to decide which of the following storage bins would hold more grain.

- Determine the volume of each bin.
- Circle the bin that has the larger volume.



$$V = \frac{\pi r^2 h}{3}$$

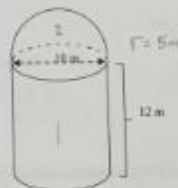
$$V = \frac{3.14 \times 9^2 \times 18}{3}$$

$$V = \frac{3.14 \times 81 \times 18}{3}$$

$$V = \frac{2543.4 \times 18}{3}$$

$$V = 4578.12$$

$$V = 1521 \text{ m}^3$$



$$V1 = \pi r^2 h$$

$$= 3.14 \times 5^2 \times 12$$

$$= 3.14 \times 25 \times 12$$

$$= 76.5 \times 12$$

$$V = 918 \text{ m}^3$$

$$V = 1203.66 \text{ m}^3$$

$$V = 1203.66 \text{ m}^3$$

$$V2 = \frac{4\pi r^3}{3}$$

$$= \frac{4 \times 3.14 \times 5^3}{3}$$

$$= \frac{4 \times 3.14 \times 125}{3}$$

$$= \frac{1570}{3}$$

$$= 523.33$$

$$= 523.33$$

$$= 523.33$$

$$3x - 2x + 2y^2 + 5y^2 = 1x + 7y^2$$

Simon adds the

exponents on the  $3x$  and  $2x$  together but they both don't have the same variable.

11. Solve the following equations.

a)  $3x + 5 = -4$   
 $3x = -9$   
 $x = -3$

b)  $4c - 8 = 6c - 4$   
 $-2c = 4$   
 $c = -2$

12. The cost,  $C$  dollars, to cater a party is given by the equation  $C = 22p + 800$ , where  $p$  is the number of people at the party.

a) What does the 22 represent in terms of this situation?

22 represents ~~22 people~~ the party cost per person.

b) What does the 800 represent in terms of this situation?

The initial cost is \$800.

c) If the party costs \$2010, how many people are attending?

$$2010 = 22p + 800$$

$$1210 = 22p$$

$$55 = p$$

∴ 55 people have to attend the party.

13. At "Rent-A-Ride", it costs \$55 to rent a car plus 10 cents per kilometer driven. Circle the equation that represents this situation and explain what is wrong with the other two equations.

$$C = 55d + 10$$

$$C = 10d + 55$$

$$C = 0.10d + 55$$

This represents 55 dollars driven every km plus 10 dollars for the car.

This represents 10 dollars per km driven plus 55 dollars for the car.

# Glebe Collegiate's MFM1P Journey

9 years - Increasing focus on activity-based learning to improve engagement

5 years - Spiralling the curriculum for repeated opportunities for retention and assessment

2 years - Combined academic and applied classes to improve mindset

1.2 years - Visibly Random Groupings and Vertical Non-Permanent Surfaces to increase accountable talk

# Spiraling Applied/Academic Combined Classes

Term 1			Term 2		
Cycle 1		Cycle 2		Cycle 3	
Measurement	Number sense and algebra/ Relationships  Exponents	Linear Relationships  patterning  $y=mx+b$ in Q1  DT graphs	Exponent laws in measurement context  more equations with measurement	Linear Relationships, $y=mx+b$  solving systems graphically, standard form	Analytic geometry/  1P: ratio & proportion
Linear Relationships	2D Measurement  2D optimization	Algebra  1D: exponent laws  1P: ratios  polynomials,  equations	Measurement: 3D  SA, volume,  Geometry concepts  Intro to parallel and perpendicular lines	Solving equations as needed to determine slope and y-intercept; review of distributive property, etc	2D/3D optimization; other problem-solving  final extensions of linear equations,  problem solving
Assessment 1	Assessment 2	Assessment 3	Assessment 4	Assessment 5	Assessment 6

# Spiraling / Interleaving / Spaced Practice

Interleaving requires learners to constantly retrieve strategies/ information and allows learners to extract more general rules that aid transfer. (Carson & Wiegand, 1979).

R. A. Bjork (1994) dubbed these effective training conditions *desirable difficulties*.

# Sample Task - Three Cycle Task

## Use Your Prior Learning to Find the Math at Tim Hortons

### Cycle 1



1. Brainstorm the math that comes to mind at Tim Hortons.
2. Organize your ideas under each of the strands of the course.

Number Sense & Numeration	Measurement & Geometry	Linear Relations & Analytic Geometry (Patterning & Data Management)

Sample Task - Three Cycle Task  
Use Your Prior Learning to Find the Math at Tim Hortons  
Cycle 2





# Sample Task

## Three Cycle Task Using Your Prior Learning to Find the Math at Tim Hortons Cycle 3

**Number Sense & Numeration:** Using the images above, make up a question that requires the use of...

1. Percentages
2. Rates and Proportions, Calculations with Exponents
3. An equation and solving an unknown variable

**Measurement & Geometry:**

5. Calculating a perimeter
6. Calculating an area or surface area
7. Calculating a volume
8. Finding an angle or sum of angles in a polygon

**Linear Relations & Analytic Geometry:**

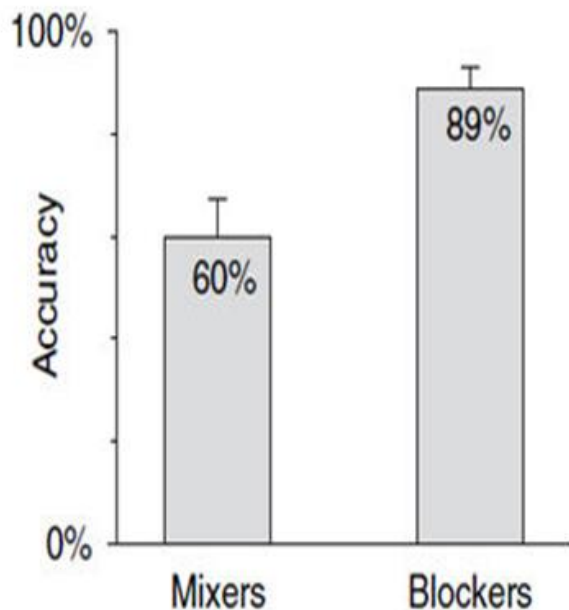
9. Investigates a linear relationship
10. Requires a table of values, scatter plot analysis and equation of a linear relationship
11. Investigates two linear relationships together
12. Investigates a non-linear relationship





# Misinterpreting Performance

**B** Practice Performance

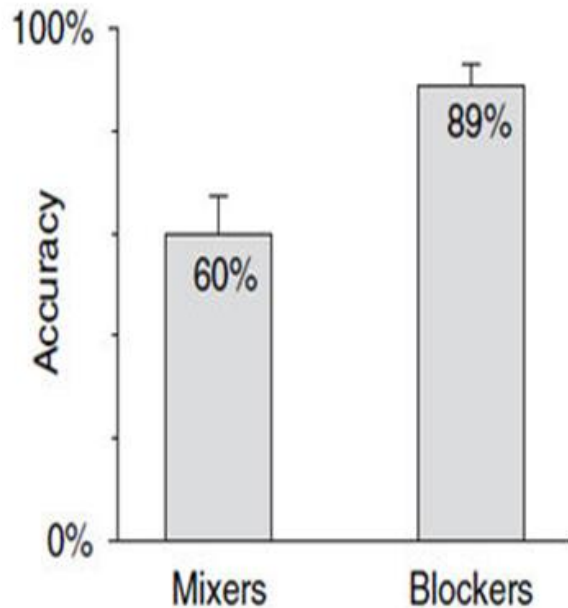


Learners and instructors frequently misinterpret short-term performance as a guide to long-term learning.

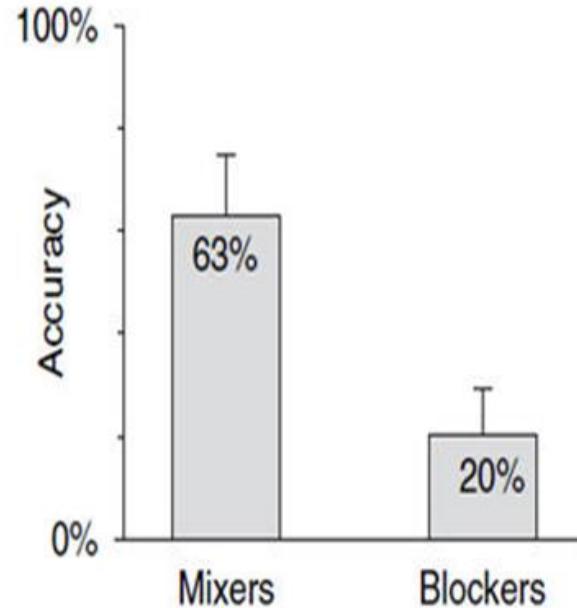
(Soderstrom & Bjork)

# Misinterpreting Performance

**B** Practice Performance



**C** Test Performance



# Misinterpreting Performance

Students were asked which worked better for them, blocking or interleaving.

80% of the interleaving practice subjects who had just outperformed the blocking group said they learned better with blocking practice. (Bjork, 1994)

## Grade 9 Test 2

Criteria for assessment:

Question	Criteria
<b>A: 3D Measurement (MG2, NA2)</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> Understanding of concepts (e.g. surface area, sum of squares)</li><li><input type="checkbox"/> Selecting tools and sequencing strategies (e.g. use of formulae, sequencing of steps)</li><li><input type="checkbox"/> Making connections between representations (e.g. diagram, equations, words)</li><li><input type="checkbox"/> Making connections to context (2D net to 3D shape)</li><li><input type="checkbox"/> Organizing ideas and mathematical thinking (e.g. substituting into formulae; labelling diagrams)</li><li><input type="checkbox"/> Reasoning and justifying (e.g. assessing reasonableness)</li></ul>
<b>B: Distance Time Graph (LR3)</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> Understanding of concepts (e.g. meaning of speed, graph interpretation)</li><li><input type="checkbox"/> Making connections between representations (e.g. graph, table)</li><li><input type="checkbox"/> Making connections to context (e.g. distance and time)</li><li><input type="checkbox"/> Reasoning and justifying</li></ul>
<b>C: Exponents (NA 1, MG2)</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> Understanding of concepts (e.g. definition of a power; volume)</li><li><input type="checkbox"/> Selecting tools and sequencing strategies (e.g. use of formulae, sequencing of steps)</li><li><input type="checkbox"/> Making connections between representations (e.g. pictures, equations)</li><li><input type="checkbox"/> Organizing ideas and mathematical thinking</li></ul>
<b>D: Relationships (AG3, AG2*, LR3*)</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> Understanding of concepts (e.g. first differences, rate of change, input and output)</li><li><input type="checkbox"/> Making connections between representations (e.g. table, graph, pattern rule, words)</li><li><input type="checkbox"/> Organizing ideas and mathematical thinking</li><li><input type="checkbox"/> Reasoning and justifying</li></ul>

\* opportunity to show additional expectations

Some people are good at math and some are not.

Sep	Jan	%
76	88	+12

People can't really change how intelligent they are in math.

Sep	Jan	%
24	35	+12

All students would be good at math if they worked hard at it.

Sep	Jan	%
53	82	+29

# Castlebrooke Secondary School Grade 9 applied journey

Initially wanted to focus on Triangulation of Evidence to see student Thinking

Decided that traditional curriculum structure made this difficult

Learned more about Spiralling at a summer institute

Took that on as our focus so that our assessment and evaluation could evolve further



# When/Why we spiralled

Started Year 1 of creating rich tasks to do within units.

Reorganizing the Curriculum started in Year 2- Summer OAME session

(where you are now) learned about Spiralling in a presentation done by Glebe.

- activity based

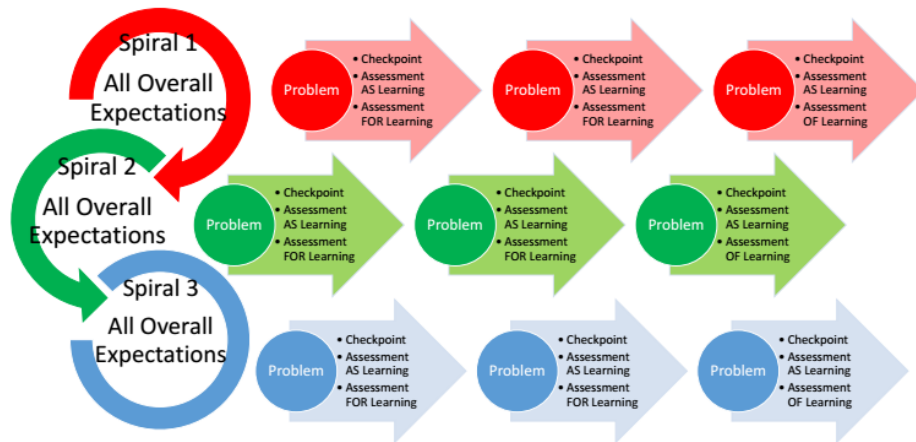
- multiple opportunities

- real world

- Made math fun!

# Our Spiralling Process:

1. Put the MFM1P curriculum into a table (see below)
1. Selected activities that met the greatest areas of need addressed above
  - a.Engagement
  - b.Showing Thinking and Making Connections
  - c.Growth Mindset
  - d.Making thinking visible
  - e. Risk taking/comfort
  - f. Embracing that math is everywhere
3. Made connections between projects and course expectations
4. Filled in any gaps missed, ensuring that all expectations were address per spiral
5. Created evaluations throughout the spiral using EQAO questions that were Assessment for/of learning





Acronym	Activity Name	Link
GB	Gummy Bear Activity	<a href="https://youtu.be/HBa458RoLpw">https://youtu.be/HBa458RoLpw</a>
SP	Sugar Packets	<a href="http://threeacts.mrmeyer.com/sugarpackets/">http://threeacts.mrmeyer.com/sugarpackets/</a>
MMP	Mini-Putt Project	
MC	Are We Movie Compatible	Attached
PP	Popcorn Pandemonium	<a href="http://mrorr-isageek.com/popcorn-pandemonium/">http://mrorr-isageek.com/popcorn-pandemonium/</a>
CT	Crazy Taxi	<a href="https://tapintoteenminds.com/3act-math/crazy-taxi/">https://tapintoteenminds.com/3act-math/crazy-taxi/</a>
R2D2	R2D2 Post-its	<a href="https://tapintoteenminds.com/3act-math/r2d2-post-its/">https://tapintoteenminds.com/3act-math/r2d2-post-its/</a>
TB	Trashketball	<a href="http://mrorr-isageek.com/trashketball-a-spiralled-lesson/">http://mrorr-isageek.com/trashketball-a-spiralled-lesson/</a>
SS	Speedy Squares	<a href="http://marybourassa.blogspot.ca/2015/03/mfm2p-day-34-speedy-squares.html">http://marybourassa.blogspot.ca/2015/03/mfm2p-day-34-speedy-squares.html</a>
SP	Stretch a Penny	Attached
KM	Kitten with Mittens	Attached
VG	Vegetable Garden	
TT	Timbits Trouble	Attached
WT	Water Tank	Attached
SBA	Super Bowl Ads	<a href="http://www.yummymath.com/2016/super-bowl-ads/">http://www.yummymath.com/2016/super-bowl-ads/</a>
DR	Dora to the Rescue	<a href="http://mrorr-isageek.com/dora-to-the-rescue/">http://mrorr-isageek.com/dora-to-the-rescue/</a>

## Number Sense

**Solving problems involving proportional reasoning.  
Simplifying Expressions and Solving Equations**

GB	SP	MMP	MC	PP	CT	R2D2	TB	SS	SP	KM	VG	TT	WT	SBA	DR
X	X	X			X	X	X	X		X					
		X		X	X				X						

## Linear Relations

- Investigate relationships between two variables
- Determining Characteristics of Linear Relations
- Investigating Constant Rate of Change

GB	SP	MMP	MC	PP	CT	R2D2	TB	SS	SP	KM	VG	TT	WT	SBA	DR
X			X		X		X	X		X					
			X	X	X		X	X							
		X		X	X		X								

## Linear Relations

## Connecting Various Representations of Linear Relations and Solving Problems Using the Representations

GB	SP	MMP	MC	PP	CT	R2D2	TB	SS	SP	KM	VG	TT	WT	SBA	DR
X				X	X		X	X		X					

## Measurement and Geometry

**Optimization: 2D shapes and the volumes of 3D figure**  
**Measurements of two-dimensional shapes, and apply the results to solving problems**

[illegible]

# Change classroom space

- Random Grouping (wrote students names on cards and shuffled every activity or day)
- Vertical Non -Permanent Surfaces (added whiteboards to surround the classroom)
- Students had their own binder that consisted of:
  - learning goal check lists
  - EQAO checkpoints

# Assessment:

- Multiple Opportunities
- Rich tasks with triangulation
- Conferences (some students)
- Observational data (for some)
- Learning Goal Checkpoints after each task
- PBL Mini Putt Project

Success Criteria	Met	Not Yet	Evidence
I can solve for an unknown value.			I said, I did or I created...
I can compare situations using unit rate.			I said, I did or I created...
I can illustrate equivalent ratios.			I said, I did or I created...
I can represent equations using equivalent ratios.			I said, I did or I created...
I can solve problems using rates and ratios.			I said, I did or I created...

LG	Question/Answer	Feedback	Corrections															
	<p>In an election for student council president, 480 students vote. Jade receives 55% of the votes. Ericka receives the rest of the votes. How many votes does Ericka receive?</p>																	
	<p>The table below shows the price per case of water at different stores. Evelyn is buying 120 bottles of water. At which store should Evelyn buy her water to pay the least?</p> <table><tr><th>Store</th><th>Price per case</th><th>Number of 500 mL bottles per case</th></tr><tr><td>Cheapies</td><td>\$1.75</td><td>8</td></tr><tr><td>Foodsmart</td><td>\$2.25</td><td>12</td></tr><tr><td>Variety Foods</td><td>\$4.59</td><td>20</td></tr><tr><td>Super Grocers</td><td>\$4.99</td><td>24</td></tr></table>	Store	Price per case	Number of 500 mL bottles per case	Cheapies	\$1.75	8	Foodsmart	\$2.25	12	Variety Foods	\$4.59	20	Super Grocers	\$4.99	24		
Store	Price per case	Number of 500 mL bottles per case																
Cheapies	\$1.75	8																
Foodsmart	\$2.25	12																
Variety Foods	\$4.59	20																
Super Grocers	\$4.99	24																

Activity							
Student name:							
1	Solving Problems Involving Proportional Reasoning						
2	Simplifying Expressions and Solving Equations						
3	Investigate Relationships Between Two Variables						
4	Determine Characteristics of Linear Relations						
5	Investigate Constant Rate of Change						
6	Connecting Repr. of Linear Relations & Solving Problems						
7	Determine the Optimal Value of 2-D and 3-D Shapes						
8	Solve Problems Involving the Measurement of 2-D & 3-D Shapes						

# Learning Stories: Open Forum

## Reorganizing Curriculum

What have you done?

What are you planning?

What are you wondering about?





# Let's keep in touch.



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